to retinal separation. De Wecker suggested that the latter was due to spontaneous rupture, permitting the serous fluid to find its way behind the retina. Leber and Nordensen maintain that in the large majority of cases retinal separation is due to a fibrillar condition of the vitreous body leading to its shrinkage and hence to traction upon the retina. The peculiar condition of the vitreous body is said to be dependent upon a chronic choroiditis. Suddenly developing separations, according to this theory, are due to rupture of the retina resulting from the traction. Rachlman, however, has called attention to the fact that the fibrillar condition of the vitreous body, noted by Leber and Nordensen, may be secondary to the separation, and that separations may occur when the vitreous body is perfectly fluid. He holds the view that a process of diffusion plays the most important part in the production of retinal separations. According to his diffusion theory, an albuminous exudate first collects behind the retina, and then fluid passes by diffusion from the vitreous body through the retina, gradually increasing the amount of fluid behind the latter, and separating the retina more and more from the choroid. It seems almost self-evident that separation of the retina having once begun, the process of diffusion must play an important part in carrying it on to completion.

Among the early subjective symptoms of retinal separation are photopsiæ, chromatopsiæ, and metamorphopsia, followed by the appearance of a dark cloud which obscures part of the visual field and produces a positive scotoma. Vision at the macula is maintained so long as the separation has not involved this region, but it is apt to be impaired in any case. The separated retina may retain light perception for a short time, and if it soon becomes readapted, it may completely resume its function. Thus the macula may be separated at first and then become reapplied to the choroid and regain its function as the separation sinks lower down. But the prognosis in retinal separations is very unfavorable, though in rare instances a spontaneous cure has resulted. Small separations occurring after an injury or as the result of retinitis, such as albuminuric retinitis, offer the best prognosis so far as the separation itself is concerned. Usually the separation increases until it is complete and there is absolute blindness. The prognosis is particularly unfavorable in myopic cases because there is no way in which we may combat the myopia. Idiopathic separation also has a highly unfavorable prognosis.

Until recently the usual *treatment* considered most satisfactory was rest in bed and the administration of diuretics, diaphoretics, and purgatives, in the hope of causing absorption of the subretinal fluid; but of late much more brilliant results have been obtained by repeated subconjunctival injections of normal or physiological saline solutions. Unfortunately, however, even after this method of treatment recurrences are common. Many surgical measures have been tried, but with indifferent success; incising the retina, withdrawing the subretinal fluid by means of a syringe, and injecting iodine with the purpose of setting up an adhesive inflammation, have all been recommended, but it is likely that they will be generally replaced by the method of subconjunctival injections.

SUBRETINAL CYSTICERCUS.—The cysticercus has been found as a parasite within or beneath the retina, but the condition is an extremely rare one, especially in this country. At first the retinal separation produced is localized over the parasite, and the movements of the latter can sometimes be observed under it. The vitreous humor soon becomes cloudy and the retinal separation becomes total, producing complete blindness, and the eye finally undergoes atrophic changes. Sometimes the parasite works its way into the retina into the vitreous humor. Drugs given with the object of killing the parasite have always proved ineffectual. When the attempt is made sufficiently early, the entozoon may be successfully removed by operation with preservation of sight.

TUMORS OF THE RETINA. (See Vol. IV., p. 112.)

Frederick Herman Verhoeff.

RETROPERITONEAL TUMORS.—This subject has received its full share of attention during the past decade and with satisfactory results. That it is still at the present time a subject of much thought and earnest research cannot be denied. Thus far, investigations go to show that in the past there have been much confusion in the pathology of these growths, many errors in diagnosis, and not a very satisfactory record regarding operative interference. Like many other problems in this great field of surgery, an early, careful study of the case, a judicious weighing of all symptoms, subjective and objective, an experienced touch, no haste, are doing much to place on a more secure basis of classification these rare growths. Careful workers in the pathology of these tumors are doing much to clear up doubtful points, and establish on a more secure basis their true nature. Operating surgeons, when the tumor has obtained full size, have not found the work of removal at all encouraging, yet it is plainly to be observed that when the growth has been reached early, a fair percentage of recoveries has been secured.

A careful study of retroperitoneal tumors shows that many of them are of a mixed variety, containing the elements of both lipoma and myxoma, tissues which are, histologically, very closely associated.

Both of these tissues are found normally in the retroperitoneum, and doubtless many of these growths arise, under suitable conditions, from congenital neoplasms. These tumors are sometimes active in their growth, often become cystic, and at times reach immense proportions. Cases are reported of tumors of this kind weighing eighty pounds. The distribution of the elements is very diverse. The fat may be regularly distributed throughout the tumor or may occur as islands located here and there. These growths are very often œdematous, and by chemical analysis present a large percentage of mucin. The microscope, besides revealing the usual elements of lipoma and myxoma, very often reveals a numerous round-celled infiltration in the stroma of the growth, pointing to a sarcomatous element in their character. While not present in all the features of active malignancy that carcinoma and sarcoma do, yet they often show a marked tendency to recur locally when removed.

Clinical histories and pathological research both show that tumors containing embryonal elements are very apt to be malignant; indeed, it may truly be said that they are always so.

The tumors found in the kidneys of young children are, for the most part, mixed tumors, chiefly myosarcomata. Many are surely congenital, and are an example of a new growth developing from embryonal tissue. They have, by Grawitz, recently been compared to a series of embryonal growths which spring from the suprarenal capsules, and have the appearance of adipose tissue, but are usually sarcomatous. (Orth, "Pathologische Diagnostik.")

Even though the tumor may not at first present the condition of true malignancy, yet the operative surgeon has learned to know that the semi-malignant growth is very apt to return either in the cicatrix or in the neighboring connective tissues, and to involve important structures, such as the large secreting glands or the lymphatics.

A careful investigation of the reported cases, together with an examination of all accessible works on pathology, impresses one with the belief that the most frequent origin of these growths is in the connective tissue of the capsular envelope of the kidney; the next most frequent seat being the suprarenal capsules.

Mr. Hulke, of Middlesex Hospital, reports a case of myxoma which enveloped the left kidney and upon which he operated. A median section was made through the tumor when it presented itself. The incision was continued through the posterior blade of the peritoneum, just beyond the descending colon. The tumor proved to be a myxoma, and although the patient recovered from the operation, the growth returned locally. The kidney was not involved by the tumor, and could have been enucleated.

The growths embraced in this class are peculiar in several respects. None can be said to be absolutely benign, even those which are made up entirely of the histological elements of either lipoma, fibroma, or myxoma, and notwithstanding the fact that they do not tend to the formation of metastases or to the infiltration of immediately surrounding tissues. It is true that they show no great tendency to recurrence when completely removed, yet from the great size to which they develop, and from their tendency to undergo degenerative changes, they cannot be classed as innocent growths.

The late Dr. John Homans, of Boston, has called attention in two papers to the reported cases of pure lipoma, among which were some on which he had himself operated.

Subserous lipomas rarely of themselves reach a large size. However, those going out from the peritoneum may be of sixty pounds' weight. Lipomas are usually slow-growing, the subserous particularly so. Subcutaneous lipomas sometimes grow rapidly after remaining stationary for years. Lipomas seldom change to other varieties, but they may primarily be mixed in character—myxolipomas.

The character of the latter group can never be determined with certainty without careful microscopical examination, as many growths having the appearance of lipomatous tissue often have the elements of myxoma and sarcoma as well. They may reach great size, but show no disposition to return after removal.

Sir Spencer Wells reports, in his first edition of "Abdominal Surgery," a case in which the removal of such a growth was undertaken, with fatal results.

Sarcomas, either in typical form or in combination with myxomatous, lymphomatous, or fibromatous tissue, also occur, and have been observed quite often. Many of the tumors which have been described as sarcomas of the mesentery were doubtless retroperitoneal sarcomas, arising at the root of the mesentery and presenting themselves anteriorly, after separating its folds.

Carcinomas are very rare, and present the strongest type of malignancy. They are of the hard, solid variety, soon forming deep and firm attachments, and offering little to be hoped for from an operation.

Varieties such as fibroma and cystoma have been observed. It may be said of the latter, for the most part, that they either spring from the walls of the pelvis, or from the subperitoneal connective tissue of that region. Virchow looks upon this series of growths as being analogous to those tumors which arise from the deep tissues of the neck.

A few remarks may be made in regard to the starting-point and relations of all these growths. Those which spring from the walls of the pelvis encroach upon or involve the bladder, uterus, and rectum, very often presenting features which are exceedingly perplexing in diagnosis. The origin of a smaller number is reported respectively as from the retroperitoneal lymphatics, the bodies of the vertebræ and bones of the pelvis, and the root of the mesentery. In by far the greater proportion of the cases no exact origin is given; indeed, from the subsequent changes in anatomical relations, it would seem quite impossible to determine the exact point of origin of many of the very large retroperitoneal new growths. They have almost uniformly presented themselves in the line of the least resistance, that is, anteriorly. In my case, reported in the *American Journal of the Medical Sciences*, January, 1892, the tumor presented itself in the back—a condition which can be attributed to its origin from the extreme upper border of the kidney, where it was less completely bound down by the lumbar muscles and fascia. When the growths have reached a sufficient size to attract the attention of the patient, they are found presenting themselves at either side of the umbilicus, somewhere in the region of the lateral lines drawn in the arbitrary divisions of the abdomen into regions, although they may appear centrally. As the growths increase in size the viscera are displaced, not infrequently completely to the opposite side, although those growths

which spring from the left kidney may have the descending colon externally. Owing to circulatory disturbances within them, and to their liability to a subsequent malignant infiltration, as well as to the development of cachectic conditions, they present, clinically, features which suggest a condition almost immediately hazardous to life.

As with any large abdominal growth, there is always a certain degree of encroachment upon the thorax and pressure upon other organs. In my second case, the tumor pushed the inferior border of the liver up to the fourth intercostal space, while the cæcum and ascending colon were displaced toward the left side of the abdomen.

DIAGNOSIS.—Notwithstanding our constantly increasing experience in abdominal surgery, we must admit that an exact diagnosis as to the true nature of these growths is not always possible. Nor can it be said to be absolutely necessary, especially in the lesser and more movable varieties.

I cannot well imagine a more severe task for a writer than to attempt to outline the symptoms and diagnosis of a condition which, until the present time, has baffled, quite without exception, the skill of all who have met with it. Yet, recognizing the importance of the factor of exact diagnosis, especially in abdominal surgery, I wish to call attention to all such symptoms as may be associated with these growths, and, after carefully weighing them, put together what seems useful.

In the first place, there is not a single symptom that is pathognomonic, and we are dependent for diagnosis upon the process by exclusion. Diseases and neoplasms of the uterus and its appendages, of the liver and the gall bladder, of the spleen, pancreas, and kidney, are to be excluded, as well as aneurism of the aorta, tumors of the mesentery, and of the abdominal walls.

The sex of the patient or the history of the case may enable one to exclude the organs of generation at once, and bimanual examination will rarely fail to locate the uterus and its appendages and determine any pathological changes in them. Pelvic congenital cysts from the spinal cord or membranes should not be lost sight of. Subperitoneal fibroids are the only ones likely to be confounded with this condition; but then uterine fibromas are more easily movable within the abdomen, and their attachment to the uterus can be made out. Solid tumors of the ovary and broad ligament present greater difficulties, which at times cannot be surmounted.

Diseases of the liver, together with new growths of that organ, have very often been mistaken for retroperitoneal neoplasms. Hypertrophic cirrhosis, amyloid degeneration, hepatic abscess, hydatids, obstruction of the cystic duct, and distention of the gall bladder, together with carcinoma and sarcoma, present physical signs which may be confounded with retroperitoneal tumors. The history of the case, together with a painstaking weighing of general symptoms, will naturally assist in clearing a doubtful diagnosis.

Disturbances of biliary excretion may occur from pressure on the common duct by the tumor. Again, tumors of the liver always move synchronously with the respiration. Retroperitoneal ones do not, as a rule. Very often a line of resonance is found between liver and tumor, which at once shows that the growth is not connected with the former organ.

My own experience teaches me that growths connected with the spleen make the case at times very embarrassing.

It has been said that the differentiation from hypertrophy and tumors of the spleen presents less difficulty than does the differentiation from tumors of the liver. Here palpation and percussion will be quite sufficient, if employed to locate the spleen in its normal position. Tumors of the omentum lack the fixed position of these growths. The absence of digestive disturbances, with fatty stools, will serve to exclude the rare new growths of the pancreas.

As stated, many of these tumors have their origin in the capsule of the kidney, or in the connective tissues

surrounding it. They present, at least in their earlier stages, physical signs differing in no respect from tumors of the nephritic parenchyma. An examination of the urine may give an exact clew to the diagnosis. In none of the cases reported had renal hemorrhage or albuminuria, with or without casts, occurred; conditions which are the rule with tumors of the parenchyma of the kidney.

Regarding the use of the aspirator, while I must admit that up to the present time it has been of no special value in the diagnosis of my cases, yet I believe that in many instances the fluid withdrawn by this instrument and carefully examined, would enable us to make a diagnosis as to classification of the tumor. In a recent case of sarcoma of the kidney, by means of the medium-sized needle I was able to draw off sufficient fluid fully to demonstrate the nature of the growth, the diagnosis being confirmed later by the autopsy. All things considered, I believe that the instrument may of be value in the diagnosis of retroperitoneal tumors.

Dr. W. G. Macdonald's suggestion to insufflate hydrogen gas into the rectum, is, I believe worthy of trial, especially where a careful examination has been made before, and the percussion areas have been outlined with care upon the abdomen. The process of insufflation should be carefully watched, that the relation of the intestinal tube to the tumor may be established.

TREATMENT.—Without operative interference there is but one termination. The rapidity of the fatal termination varies somewhat with the character of the growth. Pure lipomas are slow-growing until a certain volume is reached, when they proceed with great rapidity to a fatal termination. From a study of the clinical histories found in the literature, I am of the opinion that the mean duration of life, after the discovery of the tumor, is not more than nine months. Operative treatment offers to us much promise. Recovery has followed the removal of retroperitoneal tumors of great weight, even those weighing fifty pounds. The immediate mortality following operations is great, from necessity; yet from the hopelessness of the conditions an operation is to be urged with great earnestness upon the part of the surgeon. Incomplete operations have been immediately more fatal than those in which the tumor has been completely removed. Like all surgical lesions, these tumors illustrate the necessity of early diagnosis and prompt operation.

Czerny, in concluding a paper in which he had reported three cases, says: "In all cases operative interference can be safely undertaken; when the tumor is no longer encapsulated, the incision had better be closed, otherwise the growth should be enucleated."

Operations for the removal of retroperitoneal growths will, from necessity, be subjected to considerable modification in detail. The choice of incision will usually fall in the line of the linea semilunaris, on one side or the other; Langenbeck's incision for removal of the kidney may be made use of. Frequently, when the incision is at first exploratory it must be made in the median line. When the anatomical relations can be made out, and the operation continued by an extension of the cut, then the more favorable incision is in the linea semilunaris. By the separation of the peritoneum from the internal border of the tumor, it may be attached by sutures to the internal border of the abdominal wound, making the whole field of the operation extraperitoneal.

The incision of the posterior fold or blade of the peritoneum should be external to the attachment of the mesentery of the colon, although this is not absolutely necessary. The removal of the growth by enucleation must be accomplished with great care; particularly is it always desirable to determine the source of the blood supply and its relations to the great vessels. The vena cava has frequently been wounded by accident in the enucleation of these growths. There are likely to be large, thin-walled veins located deeply in the wound, and requiring ligation. It will be found at times necessary to remove the kidney with the tumor, and here the danger of hemorrhage is very great. The supply vessels of the kidney will frequently be found very short and difficult to reach.

The length of time required for the performance of the operation will vary necessarily. As long a time as two and one-half hours has been consumed in a difficult operation. As in all strictly abdominal work, the operator must be prepared for any and every possible complication.

After enucleation, as well as when the kidney has been removed with the growth, the cavity must be thoroughly drained, either by full-sized drainage tubes or by tamponade with iodoform gauze.

The after-treatment presents no indications for management other than those of a severe case of abdominal section.

As in all other conditions in surgery, there is certainly at the present time a better understanding of these cases. A more correct and early diagnosis, as is the case in all that pertains to medicine and surgery, will surely bring a larger percentage of recoveries.

These are purely surgical cases; no medicines, no mineral waters, or baths, electricity, or other lines of therapeutics, have as yet been of any service.

A. Vander Veer.

REVERSION.—Reversion is a special case of heredity, and the term is usually applied somewhat loosely to include all cases in which the offspring does not resemble the immediate parents, but exhibits correlation with a more remote ancestor, or group of ancestors. Recently Pearson has sought to give greater precision to the use of the term. He distinguishes (1) regression, (2) reversion, and (3) atavism.

If we take any pair of characters, as, for example, the lengths of the thumbs of the right and left hands of the same person or the statures of father and son, and construct a correlation table from a sufficiently large number of cases, it will be found that for any given dimension in one group (the "subject," *e.g.,* length of right thumb or stature of father) the dimensions of the associated characters in the other group (the "relative," *e.g.,* length of left thumb or stature of son) will be on the average nearer the general average of the whole population. This is *regression,* and is a general phenomenon of correlation when the correlation is not perfect, as is almost always the case (see article *Heredity,* Table I. and Fig. 2606). But as every individual produced sexually has two parents, four grandparents, eight great grandparents, and 2n grandparents of the nth degree, one need go back only a few generations, if there has not been much inbreeding, to find a group of ancestors sufficiently numerous to give a fair sample of the population as a whole. So, in cases of direct heredity, regression may be said to be a tendency of the offspring to depart from the peculiarity of the parent toward the general average of the ancestry.

Reversion, in the strict sense of Pearson, is a departure from the peculiarity of the parents toward the peculiarity of some particular ancestor. From the many recorded cases we may select for illustration two cases cited by Darwin. A pointer bitch produced seven puppies, four of which were marked with blue and white, a very unusual color for pointers. One of these puppies was preserved and it was found later that he was the great-great-grandson of Sappho, a pure bred pointer bitch, which he closely resembled. The other case is that of a black bull in Kincardinshire, the son of a black cow with white legs, white belly, and part of the tail white. In 1870 a calf was born which was the great-great-grandchild of the bull and had the same very peculiar markings as the bull's mother, all the intermediate ancestors of this calf having been black like the bull himself.

Atavism (Lat. *atavus,* an ancestor in the strict sense, is a return to the peculiarity of the ancestral form of the species. As this ancestral form is generally unknown, the explanation of an unusual variation as due to atavism is in most cases merely conjectural. For example, the dark stripes that appear sometimes upon the back, shoulders, and legs of horses have been attributed to atavism by Darwin, Ewart, and others; the presence of these

stripes being regarded as evidence of a striped ancestry when considered in connection with the coloring of other species of the genus Equus, like the zebra, quagga, etc. Another example of atavism is the occasional appearance of supernumerary mammæ and teats in women and in men. In women they have been observed to produce milk. These are regarded as atavistic because in the Lemuroidea, the lowest group of Primates, there are, in addition to the well-developed functional mammæ on the pectoral region, rudimentary teats upon the abdomen and groin. They thus approach the condition found in dogs and pigs, while in the apes and man there is normally but a single pair of mammæ.
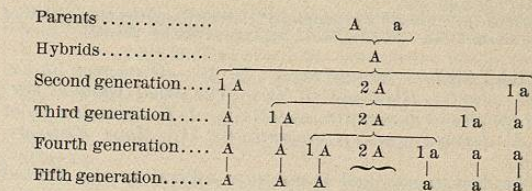
Sometimes it is difficult to determine whether a given unusual variation is a case of atavism or a sport. For example, it is known that the ancestors of the horses had three toes, and it is probable that the ancestors of the modern cats and dogs had five digits on all four feet, but dissections in some cases have shown, and it is probably true in most cases, that when polydactylism occurs in these animals the phenomenon is similar to polydactylism in man, which is certainly a sport and not atavistic.

Darwin showed that the crossing of distinct breeds of animals may result in the appearance of atavistic characters. For example, in his experiments with pigeons he found that when he crossed two distinct breeds, even when they showed no trace of blue color or of bars on the wings, the mongrel offspring would frequently exhibit some of the blue color or traces of the wing bars of *Columba livia,* the wild rock pigeon, which species he regarded as the ancestral form of the domestic pigeon. More striking results were obtained by again crossing the mongrels, the best case was the result of pairing a mongrel female barb-fantail with a mongrel male barb spot, neither of which mongrels had the least blue about them. The offspring exhibited the general blue color and every characteristic mark of the wild rock pigeon.

When individuals of separate races or species are crossed, the mongrel or hybrid offspring of the first generation may be more or less intermediate in character between the two parents, or they may resemble one parent only in some respects. But in subsequent generations there is greater diversity among the offspring, and reversion to one or the other parental type is common. The facts were noted by Darwin, but the first one to study them by statistical methods was Gregor Mendel, abbot of Brünn in Austria. Mendel's work was published in 1866, and 1870, but it remained practically unnoticed until 1900, when De Vries, happening to find a reference to it, looked it up and was surprised to discover that Mendel had anticipated results which De Vries himself was then about to publish. Mendel worked with varieties of garden peas and studied one character at a time, first testing the varieties to make sure that they would breed true. He found that when the parents possessed certain contrasted characters one character of each pair would fail to appear in the first generation of offspring, but would reappear in subsequent generations. He called the character that appears exclusively in the first generation *dominant,* while the one that reappears only in later generations he termed *recessive.* In peas he found that the rounded form of the seed is dominant and the wrinkled form recessive, the yellow color of the cotyledons of the ripe seed is dominant, the green color recessive, and the same is true of a number of alternative characteristics. Now the point of Mendel's work is that he found the dominant and recessive characters to reappear in succeeding generations according to a definite and simple numerical law.

If a certain dominant character be represented by A and the corresponding recessive by $a,$ then all the offspring of the first generation will have apparently only the character $A.$ But if the flowers of this generation are fertilized with their own pollen, the next generation will contain $1a$ to $3A.$ These plants being again self-fertilized, all of the recessives, $a,$ are found to breed true and to continue to do so during succeeding generations. One-third of the dominants also breed true in the same

way, but the other two-thirds give rise to both forms, as the hybrids did, in the same proportion of one to three.

These relations may be represented by the following diagram:

Parents .... A a

Hybrids.......... A

Second generation.... 1 A · · · 2 A · · · 1 a

Third generation.... A · 1 A · 1 A · 2 A · 1 a · 1 a · a

Fourth generation.... A · A · 1A · 2 A · 1a · a · a

Fifth generation.... A · A · A · A

If we represent pure dominants by A and dominants capable of producing both kinds of offspring by $Aa,$ and suppose each plant to produce only four seeds, the following relations will be obtained:

	A	: Aa :	a
Second generation	1	: 2 :	1
Third generation	3	: 2 :	3
Fourth generation	7	: 2 :	7
Fifth generation	15	: 2 :	15
Sixth generation	31	: 2 :	31
1 + nth generation	2n−1	: 2 :	2n−1

If we consider two or more characters at a time, the results become correspondingly complicated, for characters that are not mutually exclusive may appear in the offspring in any possible combination. Thus the seed may be dominant in shape and recessive in color, or *vice versa,* or it may be dominant in both or recessive in both.

Mendel offered as an explanation of these relations the supposition that in cases of this kind the alternative characters are not combined in the germ cells, but each carries the pure heritage of one parent only with respect to any one character, *e.g.,* the shape of the seed. That this view harmonizes with recent studies of the maturation divisions was pointed out in a previous article (see *Reduction Division*). If the chromosomes transmit the bases of separate groups of characters, as is indicated by Boveri's recent work, we may represent a pair of homologous chromosomes in the hybrid by the symbol $Aa.$ In the maturation of the germ cells with a reducing division the chromosomes would be separated into four cells thus:

$$A + A + a + a;$$

and when fertilization takes place by union with an equal number of germ cells of opposite sex containing $A' + A' + a' + a,$ the following combinations are possible:

$AA' + Aa' + aA' + aa',$ the most probable proportion being $1 AA : 2 Aa : 1aa.$

This would give one recessive to three dominants, but only one dominant out of three would breed true, for the other two would contain recessive chromosomes in their germ plasm.

The difficulty with Mendel's theory is that the statistical results obtained by other observers do not always show the exact proportions required, and that the dominant and recessive characters are variable and therefore sometimes difficult to distinguish. And also for this reason it is not easy to determine whether a race is breeding true or not. The theory has been criticised on these grounds by Pearson and Weldon; while it is defended, and its results are confirmed, by De Vries, Correns, Bateson, Castle, and others.

Robert Payne Bigelow.

BIBLIOGRAPHICAL REFERENCES.

Bateson, W.: Mendel's Principles of Heredity, with a Translation of Mendel's Original Papers on Hybridization, Cambridge, 1902.
Bateson, W. and Saunders, Miss E. R.: Report of the Evolution Committee of the Royal Society, London, 1902.
Boveri, T.: Ueber mehrpolige Mitosen als Mittel zur Analyse des Zellkerns. Ver. phys.-med. Ges. Würzburg, N. F. vol. xxxv., 1902, pp. 67–90.
Castle, W. E.: Mendel's Law of Heredity. Proc. Amer. Acad. Arts and Sci., vol. xxxviii., 1903, pp. 537–548.
Darwin, C.: The Variations of Animals and Plants under Domestication, second edition, 1875.
Ewart, J. C.: The Penycuik Experiments, London, 1899.
Pearson, K.: The Law of Ancestral Heredity. Biometrika, vol. ii., 1902, pp. 211–228.

Vries, H. de: Die Mutationstheorie, vol. ii., Leipsic, 1902-03.
Weldon, W. F. R.: Mendel's Law of Alternative Inheritance in Peas. Biometrika, vol. i., 1902, pp. 228-254.—On the Ambiguity of Mendel's Categories. Biometrika, vol. ii., 1902, pp. 44-55.
Wiedersheim, R.: The Structure of Man, an Index of his Past History, London, 1895.
Wilson, E. B.: Mendel's Principles of Heredity and the Maturation of the Germ Cells. Science, N. S., vol. xvi., 1902, pp. 991-993.

RHATANY.—(*Krameria*, U. S. P.; *Krameriæ Radix*, B. P.; *Radix Rhataniæ*, P. G.) The dried roots of several species of Krameria, especially of *K. triandra* R. et P., *K. Ixina* L., and *K. argentea* St. Hil. (fam. *Krameriaceæ*).

The last mentioned is not now official in the United States Pharmacopœia, but will doubtless be so in the forthcoming edition. The Kramerias are low or semiprostrate shrubs of tropical or warm temperate parts of America. They have very long, thick roots, noted for the thickness of their bark. Since the active constituent exists mostly in the cortex, the thicker-barked varieties are the better. The first-named grows in the higher Andes and yields Peruvian Krameria, the poorest variety. The second comes from the Santa Marta region of Colombia, and is about intermediate in quality between the first and third, which latter comes from Northern Brazil. This is usually sold as Savanilla, the genuine Savanilla now reaching the market only occasionally. *K. lanceolata* Torr., of the Southwestern United States and Northern Mexico, yields a good Krameria, but it is scarcely a commercial article.

DESCRIPTION.— *Peruvian Krameria.*—Root branches usually occurring with several or many attached to a short, hard, and woody tap root, which is 1.5-4 cm. ($\frac{1}{2}$-1$\frac{1}{2}$ in.) thick, roughly fissured and supports a knotty, several- to many-headed crown; of indefinite length, rarely exceeding 50 cm. (20 in.) and usually less than 1 cm. ($\frac{2}{5}$ in.) thick, cylindrical, flexuous or wavy, very flexible; externally light

FIG. 4110.— Krameria Triandra; transverse section of root. (Ballon.)

red-brown, more or less marked with dark, scaly patches, especially upward, otherwise smoothish, devoid of transverse fissures; fracture tough and splintery, the pinkish-brown bark occupying less than one-third of the radius, the wood yellowish or pinkish-white, finely radiate; inodorous and of a very astringent taste.

Brazilian Krameria.—Branches usually occurring detached from the tap root and crown, less flexuous than those last described, externally of a deep purple-brown or chocolate-brown and with numerous transverse cracks or fissures; fracture less tough than that of the last, the bark and wood both darker, the former occupying two-
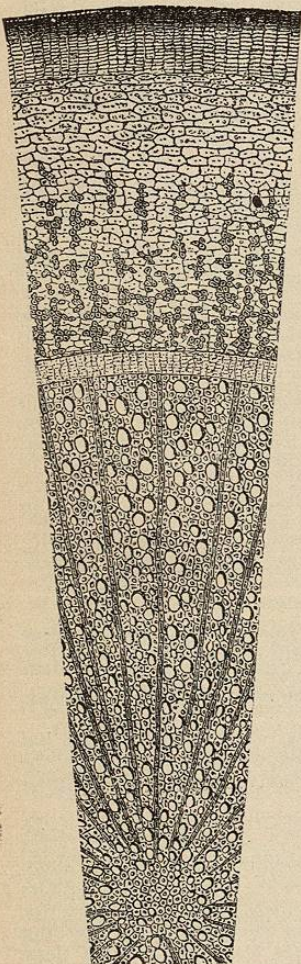
fifths, or even more, of the radius, the taste more astringent than that of the last.

The most important constituent is from eight to twenty per cent. of *krameria-tannic acid* or *rhatania-tannic acid*, a brilliant deep red amorphous mass, soluble in alcohol and, if pure, in water also. It is usually only partly water-soluble, owing to the change of a portion of it to phlobaphene by dehydration. Krameria-tannic acid gives a dull green color with diluted acids, and is flesh-colored with gelatin. It is decomposed by dilute mineral acids into sugar and rhatania red.

Published statements as to the relative percentages of tannin in the different varieties are not reliable, since it is the very commonest occurrence for the varieties to be confused in commerce and in experiments.

Rhatany is a reliable and useful astringent, owing to its tannin, and is applicable to all conditions in which gallic or tannic acid is useful. It occurs in tasteless white acicular crystals, which are but sparingly soluble in water. Overlach finds its action practically specific in acute rheumatism, without any digestive disturbances, and distinct from that of a mixture of quinine and salicylic acid. Pieper found it valuable in trigeminal neuralgia as well as in rheumatism. The dose is 1 gm. (gr. xv.) three or four times a day. *W. A. Bastedo.*

RHEUMATISM, ACUTE ARTICULAR.—DEFINITION.—An infectious disease, caused by a germ or germs not yet identified, and characterized by (1) a general constitutional reaction; (2) an irregular febrile movement; and (3) non-suppurative inflammation of the connective-tissue structures of the joints, the muscles, and the heart.

HISTORY.—In former times articular rheumatism was confounded with gout. Sydenham, in the closing years of the eighteenth century, first made plain the difference between the two diseases.

NATURE.—Rheumatism is now regarded almost universally as an infectious disease caused by germs from without. Two other theories were formerly held: first, that it is due to the presence of an excess of lactic acid in the blood; second, that it is of neurotrophic origin. These views are no longer held by the best men. With regard to the first, it need only be said that it offers no reasonable suggestion as to the cause of the excess of lactic acid. An excess of lactic acid is almost always present, but it is no more logical to say that the lactic acid causes the joint troubles than that the joint troubles cause the lactic acid, or that the fever causes both.

The second, or neurotrophic, theory is open to objection on the ground that it offers no cause for the neurotrophic disturbances. Furthermore, if so serious and acute a disease as rheumatism be neurotrophic in its origin, we ought to find in every case serious disturbance of the central nervous system, while as a matter of fact such disturbance is very uncommon. Again, all other diseases of proven neurotrophic origin are of slow progress and conspicuously slow recovery, which rheumatism, under proper treatment, is not. The neurotrophic theory is really founded upon a confusion between articular rheumatism and rheumatoid arthritis. The latter disease is now regarded as neurotrophic, but its morbid anatomy and clinical picture are so different from those of rheumatism that the two diseases may be said to have nothing in common except that they both affect the joints.

In favor of the germ theory of rheumatism we may urge the following arguments: (1) All other acute diseases with fever and constitutional reaction are now believed to be infectious. Most of them have been proven so.

(2) All other acute inflammations of joints—*e.g.*, pyæmic, gonorrhœal, tuberculous, and syphilitic arthritis—are known to be infectious. (3) Acute rheumatism has several times been found to occur in epidemics. (4) There are two cases on record in which parturient women, suffering from rheumatism, have borne children who shortly after birth developed fever and polyarthritis.

The bacteriology of rheumatism is still in doubt. In 1891 Achalme, of Paris, claimed to have identified the germ. He isolated from the blood and pericardial fluid of, in all, eight rheumatic patients, a bacillus which he regarded as characteristic. It was found, however, that cultures of this bacillus, injected into animals, produced not the ordinary lesions of articular rheumatism, but local congestion, destruction of tissue, and gas bubbles. Westphal, Wasserman, and Malkoff, in 1899, found in a fatal case of post-rheumatic chorea a very few diplococci which produced in animals fever and non-suppurative polyarthritis. Poynton and Paine, of London, in 1900 found a diplococcus which may prove to be this same germ. They isolated it from eight cases of severe acute rheumatism, finding it in the blood, the pericardial fluid, the vegetations from diseased heart valves, the tonsils, and the urine. They also demonstrated its presence in the joint exudations of inoculated rabbits. These rabbits showed multiple, non-suppurative arthritis, valvular endocarditis, pericarditis, and moderate pyrexia. Passed along from one animal to another, the germ showed great constancy in its effects. These results are very striking, but up to the time of writing no confirmatory reports have been published.

A view which has gained some support during the past year is that rheumatism is due to the presence in the body, not of bacteria, but of toxins. F. W. Packard, of Philadelphia, has declared in favor of this view, and has also stated that in a large number of cases the intoxication results from an infected tonsil. It is certain that tonsillitis is of very common occurrence at the beginning of an attack of rheumatism, and it may be imagined that the lymphoid tissue of the tonsil, by its power of filtration (Manfredi) allows the toxins to pass through and stops the bacteria. The emigration of the inflammation from joint to joint, so often seen during an attack of rheumatism, seems to suggest a local intoxication rather than infection, and so also does the rapid and complete recovery under proper treatment. And salicylic acid, while a very weak germicide, is known to have a powerful chemical action upon toxins, *e.g.*, diphtheria antitoxin. There is need for further investigation along this line.

ETIOLOGY.—Rheumatism is seen everywhere. It is most common in temperate climates. In New York it occurs most frequently during the early months of the year. A series of 514 consecutive cases from the records of the New York Hospital gave the following results:

Season of year: July 1st to January 1st, 140 cases; January 1st to July 1st, 374 cases.

Sex: Of all ages, 337 males, 177 females.

Of cases under 20, 43 males, 44 females.

Age: Under 10 years, 6 cases, or 1.17 per cent.; 10-20 years, 81 cases, or 15.8 per cent.; 20-30 years, 200 cases, or 38.9 per cent.; 30-40 years, 130 cases, or 25.3 per cent.; 40-50 years, 66 cases, or 12.8 per cent.; 50-60 years, 23 cases, or 4.47 per cent.; over 60 years, 8 cases, or 1.55 per cent.

These figures are in general agreement with those for the Montreal General Hospital, quoted by Osler. It will be seen that rheumatism is pre-eminently a disease of early adult life, nearly sixty-five per cent. of the cases occurring during the period of greatest bodily and mental strain, or between the ages of twenty and forty. The difference in susceptibility between men and women is hardly explainable except upon the ground of difference in occupation and women's freedom from the alcoholic and tobacco habits.

Many observers claim a distinct hereditary predisposition (Osler, Church and Cheadle, Lyman). But, as many different conditions have in the past been grouped to-

gether under the common name of rheumatism, the importance of an hereditary predisposition may have been exaggerated.

Exposure to cold, especially *damp* cold (Lyman), is the exciting cause in a certain number of cases. Men who lead outdoor lives, exposed to all kinds of weather, and who are—as this class often is—somewhat alcoholic, are very liable. Second and third attacks are common. Of the 514 cases quoted above, 64 had had one previous attack, and 43 more than one; so that one attack of rheumatism confers no immunity as regards subsequent attacks.

MORBID ANATOMY.—Typical rheumatism always attacks more than one joint. A case of monarthritis without history of previous attacks should be viewed with doubt. The inflammation is exudative in type, with congestion and a fibrino-serous exudate, containing a few leucocytes, in all the tissues of the joint proper, and also in the cellular tissue and tendon sheaths around the joint. There are rarely, if ever, in an uncomplicated case enough leucocytes to make the exudate purulent. The synovial fluid, with which the joint cavity is distended, is sometimes of acid reaction and may be blood-stained. The cartilage cells in the joint cartilages proliferate, and the intercellular substance splits up, assuming a velvety appearance. All these changes are susceptible of rapid repair.

The blood shows increase of fibrin, fats, cholesterin, and extractive matter. The serum remains alkaline. Urea and uric acid are not increased. Red blood cells are much diminished. No disease produces pronounced anæmia quicker than acute rheumatism.

The urine is acid, high-colored, and of high specific gravity. It deposits, upon standing, a sediment of amorphous urates and sometimes uric-acid crystals.

There is an excessive excretion of sweat. This is of neutral reaction, but quickly becomes acid if the patient's skin be not kept scrupulously clean.

CLINICAL HISTORY.—In the majority of cases the first symptom noticed is lameness of one or more joints. This may be preceded, during a few days, by the symptoms of an ordinary coryza or acute pharyngitis or tonsillitis. The slight lameness and soreness are usually overlooked, and the patient continues to follow his ordinary occupations. After a few days more the symptoms grow worse, swelling and redness appear in the affected joints, the pain increases until the least motion causes agony, there is a febrile movement, with or without distinct chills, anorexia, constipation, and profuse sweating, and we have the full clinical picture developed. In a few cases the disease is ushered in by a rigor, with an immediate development of all the symptoms; or the case may begin in a mild way, and later develop suddenly the graver and more acute type.

When the disease is once established, it shows very little tendency to spontaneous termination. Under the older systems of treatment it would run for many weeks. The inflammation may move entirely in a few hours from one part of the body to another—from knee to wrist, from wrist to ankle, or from one leg or arm to the other. Of the location of the disease it is a noteworthy fact that it shows a marked tendency to attack the same joint on both sides of the body. In the above-quoted series both knees were involved in 213 cases, the left knee alone in 79, the right knee alone in 59. All the joints of the body showed at least a plurality of cases of symmetrical involvement. The knee is the most frequent seat of inflammation, 351 cases showing affection of one or both. The ankle came second in my series with 256 cases; next the wrist, 125 cases; shoulder, 116; foot, 109; hand, 97; elbow, 78; hip, 44; and lastly the sternoclavicular joint, 1 case. The fever is irregular, rarely very high except in cases of hyperpyrexia, and yields more readily to the salicylates than do the joint troubles.

COMPLICATIONS.—Of these the most important are those which affect the heart. Indeed, were it not for the cardiac complications, an attack of rheumatism would be little more than a disagreeable incident in a man's life.